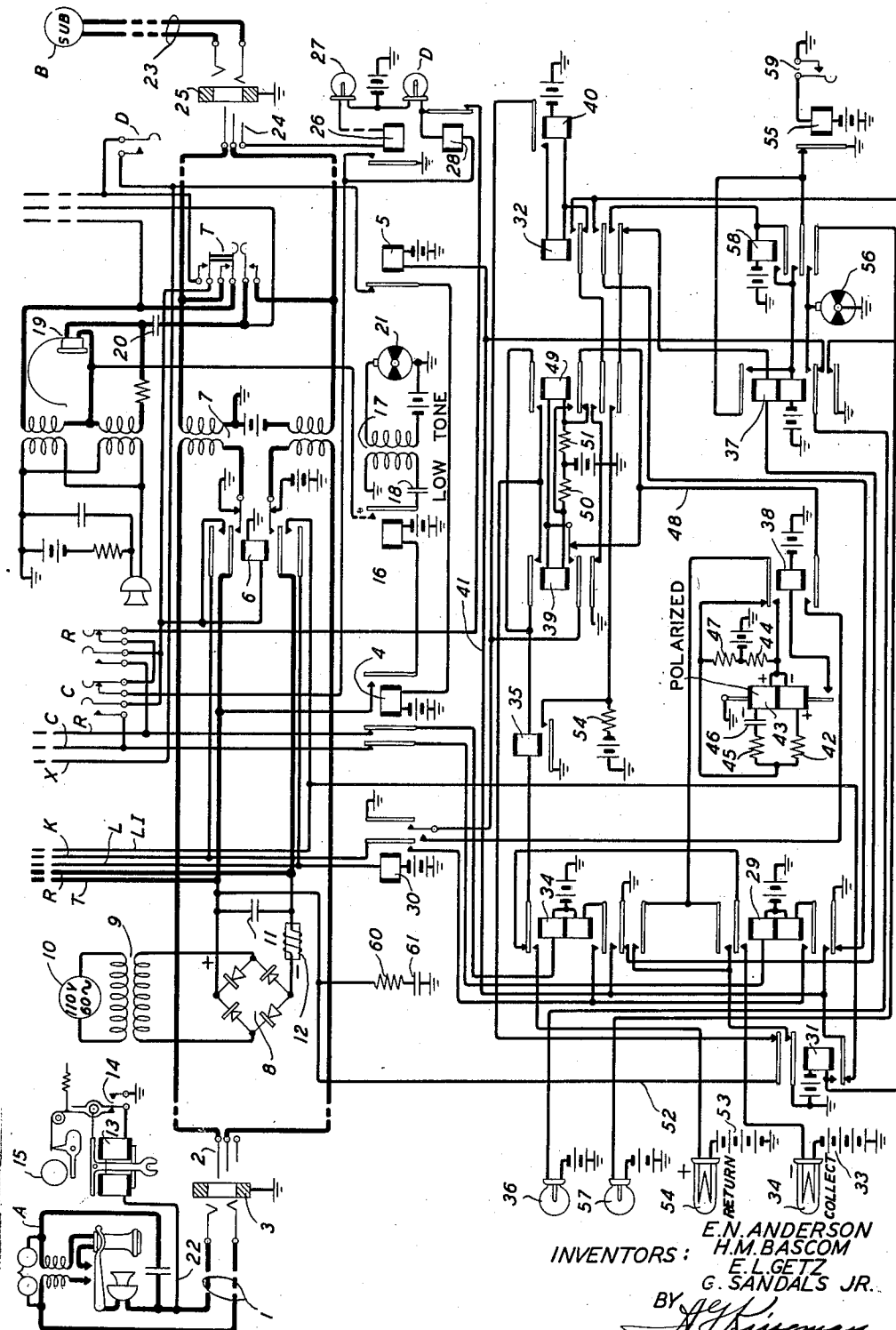


June 15, 1937.

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PREPAYMENT TELEPHONE SYSTEM

2,084,121

Filed Aug. 8, 1935



UNITED STATES PATENT OFFICE

2,084,121

PREPAYMENT TELEPHONE SYSTEM

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Application August 8, 1935, Serial No. 35,226

20 Claims. (Cl. 179—6.3)

In a copending application, Serial No. 8,588, filed February 28, 1935, in the name of Henry Hovland, to which reference is hereby made, an arrangement is described for automatically testing prepayment coin box lines at the time of collecting the coin in order to detect fraudulent attempts to obtain service without depositing the required coin.

In the arrangement described in that application a pilot lamp at the central office operator's position is lighted responsive to operation of the coin disposal key and continues to burn steadily after the key is released if no ground was present on the line when the coin potential was applied, or if ground was present at that time but did not disappear responsive to the first application of such coin potential.

An object of the present invention is to automatically signal the operator by means of a flashing lamp whenever a non-standard condition exists at a calling subscriber's prepayment coin box station, i. e., ground which is not removed by the application of coin potential to the line, or absence of ground when the coin potential is first applied.

Another object is to give the answering operator a preliminary audible signal in case a ground condition exists on the calling line, the absence of such signal immediately warning the operator that the subscriber has not deposited a coin.

Another object is to visually signal an operator whenever a cord circuit at her position requires operation of an associated coin disposal key and to maintain such indication until the key is operated.

Still another object is to prevent annoying clicks in the subscriber's receiver and interference with conversation when coin potential is applied to the line during such conversation.

A feature of the present invention, which constitutes an improvement over the system described and claimed in the beforementioned Hovland application, consists in the provision of means for changing the steadily lighted coin pilot lamp to a flashing lamp in case no ground is encountered when the coin potential is first applied or when it encounters ground upon a second application thus indicating that the first application failed to clear the line.

A feature related to the foregoing is a second coin pilot lamp which is caused to flash in unison with the first pilot lamp only when ground is encountered upon the second application of coin potential to the line.

Another feature is an arrangement whereby

the operation of a key, common to the operator's position, during the interval the operator is connected to a cord circuit associated with a calling coin line, and prior to the operation of a coin disposal key, will cause an audible signal to be given to the operator if a ground is present on the line at the time.

Another feature is the provision of a guard lamp individual to each cord circuit and so arranged that it will be lighted immediately upon connection of the calling end of the associated cord circuit with an out trunk jack or other line and will remain lighted until the operator actuates a coin disposal key associated with that particular cord.

Still another feature consists in substituting, responsive to actuation of a coin disposal key and during the period coin potential is being applied to the line, a non-grounded source of talking current for the regular grounded central office battery whereby conversation may be carried on between the calling and called subscribers without interference therewith by the coin potential.

The invention will be understood from the following description when read in connection with the accompanying drawing at the left of which is represented a calling subscriber's line 1, with an associated line jack 3, which terminates in a coin box station A of the usual prepayment type. At the right is indicated a called subscriber's line 23 with associated line jack 25 and substation B. To connect the calling and called stations an operator's cord circuit, arranged according to this invention, is shown. It is provided with the usual coin collect and coin return keys C and R for the disposal of coins deposited at the calling station and is similar to other cord circuits installed at the same position but not shown. In addition to the cord circuit other apparatus, common to the position, is shown. This common apparatus is arranged, according to this invention, to cooperate with the cord circuit shown on the drawing, and through eleven vertical multiple leads with the other cord circuits (not shown), in disposing of coins at the calling station and in giving certain indications to the operator of the deposit or non-deposit of a coin by the calling subscriber. This will be fully described hereinafter.

A detailed description of the operation of the invention will now be given.

Let it be assumed that the subscriber at station A desires to be connected with the station of subscriber B. To call the operator at the central office, a coin must first be deposited at

station A, if the line circuit (not shown) associated with the answering jack 3 is arranged according to the so-called "nickel first" plan. With this arrangement a circuit is closed from ground, through coin contacts 14, which were operated when coin 15 was deposited, winding of coin-magnet 13, over tip conductor of line 1 and through the winding of a line relay (not shown), to battery at the central office. If the aforesaid line circuit is arranged according to the so-called "nickel last" plan it is not necessary for the calling subscriber to first deposit a coin to obtain the attention of the operator. With this arrangement, removing the receiver from the switch-hook at station A operates the line relay over the line conductors in the well-known manner.

In response to display of the line signal, not shown, the operator inserts answering plug 2 of the associated cord circuit into jack 3 and having ascertained from the calling subscriber that he desires to converse with the subscriber of station B, now proceeds to establish the desired connection, which, it is assumed is one that requires the collection of a toll charge.

If the line circuit is arranged on a "nickel last", basis as explained before, the operator, using a feature of this invention, would now test the calling line to determine whether there is a ground at station A, which would indicate that a coin has been deposited. If the line circuit should be arranged on a "nickel first" basis no test is required, since the display of the line signal is the equivalent of a test and indicates ground at station A; accordingly, the apparatus for this line testing feature of the invention may be omitted for this class of service, i. e., "nickel first".

Assuming that the line circuit is arranged on a "nickel last" basis, the operator makes the aforesaid ground test by the operation of the detector key D, common to the position, while the talking key T of the cord circuit is also operated. A circuit may now be traced from battery through the winding of relay 4, contacts of relay 5 and detector key D, upper outer contacts of key T and winding of relay 6 to ground. Relays 4 and 6 operate in series. Relay 6 in operating disconnects with its upper and lower inner break contacts ground and battery respectively from the left-hand windings of repeating coil 7, and connects with its upper and lower inner make contacts an approximately equal, ungrounded potential supplied by the full wave rectifier 8, common to the position, which is energized through transformer 9 from a source of commercial alternating current 10. This rectifying arrangement, including the filter consisting of condenser 11 and retardation coil 12, is well known and requires no description here. It is to be understood that any other suitable source of ungrounded potential, such as a dry cell battery, may be used, if desired.

The transfer from a grounded to an ungrounded source of current enables the test for ground at station A to be made without interrupting the current supply to station A. When relay 4 operates it connects battery through the winding of relay 16, right-hand contacts of relay 4, upper inner make contacts of relay 6, upper left-hand winding of repeating coil 7, tip conductors of plug 2 and jack 3, over tip conductor of line 1 and through the winding of coin-magnet 13, and operated contacts 14 to ground, provided the subscriber or station A has deposited a coin 15. Relay 16 operates in this circuit

but coin magnet 13 does not receive sufficient current for its operation at this time. Relay 16 connects the left-hand winding of transformer 17 through condenser 18 to the lower terminal of operator's receiver 19. From this point a circuit is completed through the winding of receiver 19, condenser 20, lower operated contacts of key T, lower right-hand winding of repeating coil 7 to battery and ground. The primary or right-hand winding of transformer 17 is energized by current interrupted by interrupter drum 21, which may be driven at a suitable speed to cause a characteristic low tone to be heard in receiver 19. This indicates that a ground is present at station A due to the deposit of a coin, assuming that the apparatus of station A has been manipulated in a standard manner. On hearing the aforesaid tone the operator now restores keys D and T, releasing relays 4, 6 and 16. If no tone should be heard, it is an indication that a coin has not been deposited. Accordingly, the operator will now request that a coin be deposited. If, however, conductor 22 should be grounded fraudulently in order to obtain free service, or otherwise grounded, the tone aforesaid will still be heard, but the irregular condition will be detected later, in accordance with a feature of the invention to be described hereinafter.

Assuming that the test before described would indicate the deposit of a coin at station A, the operator proceeds to establish the connection with line 23 of station B, by inserting the calling plug 24 into jack 25, and ringing on the line in the usual manner. The ringing key and the ringing circuit connections, not being necessary for a description of this invention, are not shown. When the subscriber at station B answers, the conversational connection is completed, and the operator now proceeds to collect the coin at station A, the apparatus of the invention functioning as hereinafter described.

When calling plug 24 was inserted into jack 25 a circuit was closed for operating a sleeve relay 26 from ground on the sleeve contacts of jack 25 through supervisory lamp 27, which is lighted or extinguished in accordance with the functioning of the usual associated supervisory relay, not shown. Relay 26 in operating closes a circuit for lighting the coin disposal lamp D which may be traced from ground on the contacts of relay 26, through normally closed contacts of keys C and R and of relay 28, and lamp D to battery. As long as this lamp D remains lighted, the operator is reminded that no disposal of the coin 15, by operating one of the disposal keys C or R, has been attempted. To collect the coin 15 collect key C is now operated which opens the circuit of lamp D just traced and also removes a short circuit around the winding of relay 28 which now operates in series with lamp D which lamp is extinguished by reason of the high resistance of the winding of relay 28. Relay 28 remains operated until plug 24 is removed from jack 25 at the end of the conversation. The C key operated, operates relays 6 and 29 in series in a circuit extending from ground through the winding of relay 6, left-hand operated make contacts of key C, outer left-hand break contacts of relay 4 and upper winding of relay 29 to battery. The operation of relay 6 transfers, by means of its upper and lower continuity contacts, the inner terminals of the left-hand winding of repeating coil 7 from grounded battery to the beforementioned ungrounded source of current supplied by rectifier 8, which source is approximately of the

same potential as that of the grounded central office battery. Due to the use of "continuity contacts" and this approximate equality of potential of the two sources of current, a very slight click, if any, will be heard by the calling subscriber. Relays 6 and 29 in operating also close a circuit for operating relay 30, which may be traced from battery through the winding of relay 30, lower outer operated contacts of relay 6, lower back contacts of relay 31 to ground on the operated, outer lower front contacts of relay 29. When relay 30 operates a locking circuit is closed, for holding operated relays 6 and 29, which circuit may be traced from ground through the winding and upper outer make contacts of relay 6, inner operated contacts of relay 30, lower inner operated contacts and lower winding of relay 29 to battery. Relay 29 operated, disconnects ground on its lower back contacts from the middle armature of relay 32, closes negative coin collect battery 33 through resistance lamp 34, its upper inner make contacts and the upper back contacts of relay 34 to the winding of relay 35. Relay 29 operated also closes a circuit through lamp 36 which is traced from battery through lamp 36, back contacts of relay 37, over conductor 41 and through lower, outer make contacts of relay 29 to ground. Lamp 36 lights steadily in this circuit. Relay 5 also operates from ground on conductor 41, and opens, at its break contacts, the circuit of detector key D, thus avoiding the possibility of operating relay 4 while coin disposal current is on the line. Also, ground on the upper inner break contacts of relay 31 is connected through the upper outer make contacts of relay 29 to the upper armature of relay 38.

The operation of relay 30 connects ground, at its outside make contacts, to the lower inside armature of relay 39 and the armature of relay 40 and, at its middle make contacts, connects ground to the lower front contact of relay 38. Ground connected to the upper armature of relay 38, as hereinbefore described, causes current to flow through resistance 42, the lower winding of polarized relay 43 and resistance 44 to battery. Current also flows momentarily through resistance 45, condenser 46, the upper winding of relay 43 and resistance 44 to battery. The current flow through the lower winding of relay 43 is in a direction to operate relay 43 while the current through the upper winding opposes operation so that relay 43, at first, does not operate. However, after an interval condenser 46 becomes fully charged and the current through the upper winding of relay 43 consequently ceases, leaving the operating current in the lower winding unopposed. Relay 43 now operates and operates relay 38 over an obvious circuit. Relay 38 in operating connects ground at its upper front contacts to the common right-hand terminal of relay 43, which causes current to flow through the lower winding and resistances 42 and 47 in a direction to cause the release of relay 43, and through the upper winding, condenser 46 and resistances 45 and 47 in a direction to oppose release. After an interval condenser 46 is charged fully to a potential of polarity opposite to that of the previous charge and then the current in the lower winding of relay 43 is unopposed and relay 43 releases, causing the release of relay 38. The cycle of operation and release is then repeated. Relay 38 accordingly applies intermittent ground through its lower contacts to conductor 48. Resistances 42, 44, 45 and 47 and the capacity of condenser 46 are so evaluated as to

cause the pulsing speed of relay 38 to be suitable for the satisfactory functioning of relays 39 and 49, and of the coin relay 13 at station A as will be hereinafter described.

When relay 38 first operates and ground is applied to conductor 48, relay 39 operates through its inner normally closed contacts and winding and resistance 50 to battery and locks through its lower inner make contacts to ground on the operated outer front contacts of relay 30. Relay 39, at its upper contacts, connects the winding of relay 35 to the tip conductor of line 1, to which negative coin battery has been previously connected as before described. The complete circuit is now traced from negative battery 33, ballast lamp 34, upper inner contacts of relay 29, uppermost contacts of relay 34, winding of relay 35, upper contacts of relay 39, through upper outer normally closed contacts of relay 31, upper inner operated front contacts of relay 6, upper lift-hand winding of repeating coil 7, tip contacts of plug 2 and jack 3, over tip conductor of line 1, through winding of coin relay 13 and operated contacts 14 to ground, causing the collection of coin 15. Relay 35 operates in this circuit and connects ground to the lower, outer make contacts of relay 49. On the first release of relay 38, after the first closure of its contacts, relay 49 operates due to the removal of ground from its lower normally closed contacts. The operating circuit may be traced from battery through resistance 51, winding of relay 49 and lower operated front contacts of relay 39 to ground on the outer operated make contacts of relay 30. On the second closure of the lower contacts of relay 38, relay 39 releases due to a short-circuiting ground connected from conductor 48 through the lower, inner operated front contacts of relay 49 to the lower winding terminal of relay 39. Relay 49 remains operated from battery through resistance 51, winding of relay 49 and lower inner back contacts of relay 39 to ground on conductor 48, maintaining the connection of coin battery 33. With relay 39 released a circuit is closed for operating relay 40 which is traced from ground on the lower outer contacts of relay 39, lower middle make contacts of relay 49, inner back contacts of relay 32 and winding of relay 40 to battery. On the second open interval of the lower contacts of relay 38, after the aforesaid second closed period, relay 49 releases due to the removal of ground from conductor 48. With relays 39 and 49 both released, negative coin battery is disconnected, relay 35 releases, coin relay 13 and associated contacts 14 are restored to normal, and relay 32 operates in series with relay 40 due to the removal of ground from its lower, inner back contacts.

On the next, i. e., the third, operation of relay 38, relay 39 will operate again to connect negative coin battery as before, but since it is assumed the coin 15 has been disposed of, i. e., collected, ground is removed from the winding of coin relay 13 and relay 35 now does not operate. On the next, i. e., the third, release of relay 38, relay 49 operates as before, and on the fourth operation of relay 38, relay 39 releases as before but now closes a circuit for the operation of release relay 31 which is traced from battery through the winding of relay 31, inner operated make contacts of relay 32, middle make contacts of relay 49 and ground on the lower outer normal contacts of relay 39. The operation of relay 31 disconnects ground on its upper

inner break contacts from the upper outer contacts of relay 29 and the upper armature of relay 38, which stops the pulsing circuit, opens at its upper outer back contacts the coin battery lead 52, and opens at its lower back contacts the circuit for relay 30 which releases. Relay 30 in releasing opens the locking circuit for relays 6 and 29 and 32 and 40, which release. Relay 29 in releasing releases relay 31. All apparatus used in connection with the disposal of coin 15 is now restored to normal, including lamp 36 which is extinguished. When the coin battery 33 is disconnected from the coin magnet 13, the effect of inductive discharges over the line is minimized by the discharge path to ground consisting of resistance 60 and condenser 61.

In connection with the description hereinbefore given, particular attention should be called to the feature of the invention whereby the use of the ungrounded rectifier 8 enables the grounded coin battery to be applied directly to the tip conductor of the line without interrupting the talking battery supply. This avoids the possibility of any undesirable acoustic disturbances on the line as well as avoiding the necessity of interrupting the conversation between the subscribers when the collection is made while the connection is established.

The description before given was for the collection of the coin. The operation of the invention will now be described for the return of the coin.

Let it be assumed that a coin 15 has been deposited and that the apparatus of the invention has functioned, as before described, up to the point where the operator actuated the collect key C. It is now to be assumed that the return key R is actuated, due to the called line being found busy, failure of the called subscriber to answer, or for some other reason requiring the return of the coin. With the R key operated, a circuit is closed for operating relays 6 and 34 in series, which circuit may be traced from battery through the upper winding of relay 34, left-hand inner break contacts of relay 4, left-hand make contacts of key R and winding of relay 6 to ground. Relay 6 in operating disconnects grounded battery from the left-hand windings of repeating coil 7, and substitutes the rectifier 8 and its associated filter, in the same manner as hereinbefore described and also closes a circuit for operating relay 30. This circuit may be traced from battery through the winding of relay 30, lower outer make contacts of relay 6, lower break contacts of relay 31 to ground on the lower, middle, operated make contacts of relay 34. Relay 30 in operating closes a locking circuit for relays 6 and 34 which may be traced from battery through the lower winding and lower inner make contacts of relay 34, inner make contacts of relay 30, upper outer make contacts and winding of relay 6 to ground. Relay 30 in operating also performs additional functions which are the same as those before described. Relay 34 in operating connects ground on the upper, inner break contacts of relay 31 through its lower, outer make contacts to the upper armature of relay 38. Positive coin return battery 53 is also connected through resistance lamp 54 and the operated upper front contacts of relay 34 to the winding of relay 35, and lamp 36 is again lighted over the circuit before traced, from ground on the lower middle make contacts of relay 34. The arrangement now functions as previously described except that, after relay 32 operates, a circuit

closed for operating release relay 31, which circuit may be traced from battery through the winding of relay 31, middle operated make contacts of relay 32 and lower back contacts of relay 29 to ground. Relay 31 locks to ground on the lower middle make contacts of relay 34, opens the coin control lead 52 with its upper outer break contacts, opens the operating circuit of relay 30, which releases and disconnects ground with its upper, inner, break contacts from the armature of relay 38, thereby preventing any additional pulsing by relay 38. When relay 30 releases, relays 32, 40 and 34 release. When relay 34 releases, relay 31 releases and all apparatus is restored to normal including lamp 36.

If the associated line circuit is arranged for "nickel last" operation, the calling subscriber is not required to deposit a coin at station A for a free or privileged call, as the deposit of a coin is not required to obtain the attention of the operator. In this case, when the operator actuates the R coin disposal key in order to extinguish the coin disposal lamp D and to assure the return of any coin that may have been unnecessarily deposited, relay 37 does not operate because ground is removed from the winding of relay 37 by the operation of the lower back contacts of relay 34. After the fourth closure of the lower contacts of relay 38, relay 39 is released and relays 49, 32 and 40 are operated. A circuit is then closed for operating release relay 31, which is similar to that traced in the hereinbefore given description for standard operation in the collection of a coin. Relay 31 in operating causes the release of the circuit as described before.

The description hereinbefore given covered the functioning of the invention for normal operation, that is, for the standard manipulation of the apparatus at station A. The invention will now be discussed for non-standard operation. The following non-standard conditions are assumed: (a) coin not deposited for a toll call; (b) coin not deposited for a toll call and an improper ground connected to conductor 22 of substation A which is not removed prior to the operation of the collect key C.

The description hereinbefore given for a collect call under standard conditions applies for the non-standard condition (a) up to the point where relay 49 first operates. When relay 49 operates a circuit is closed for operating relay 37 which is traced from battery through resistance 54, lower outer make contacts of relay 49, lower outer break contacts of relay 32, upper winding of relay 37 and lower break contacts of relay 34 to ground. Under the standard condition previously described relay 37 did not operate because relay 35 operated due to the ground applied at station A by reason of the closing of coin contacts 14 by coin 15. Relay 35 operated, short-circuited the winding of relay 37 preventing its operation. Under the condition (a) now being discussed, relay 35 does not operate because of the absence of ground at station A and consequently the previous shunting effect is not present.

Relay 37 in operating locks through its lower winding and upper make contacts to ground on the break contacts of relay 55, transfers lamp 36 from its connection to ground on the lower, outer front contacts of relay 29 to interrupter 56. Also, release relay 31 is operated from ground on the lower outer front contacts of relay 37, and all coin control apparatus is now restored to normal except relay 37 and lamp 36 which flashes in unison with the interruptions furnished by inter-

rupter 56. Lamp 36 flashing alone, unaccompanied by a lamp 57 flashing, as will be described hereinafter, indicates there was no ground at station A at the time that collect key (C) was operated.

The operator, thereupon, may operate the talk key T thereby connecting her telephone set to the cord and request the subscriber at station A to deposit a coin after which she may operate release key 59 which operates relay 55 thereby removing the locking ground from the lower winding of relay 37 which releases and changes lamp 36 to a steady signal once more. After a reasonable interval of time, or when the operator hears the coin deposited, the operator again operates collect key C which reinitiates operation of the timing circuit and the application of two more impulses of collect current from battery 33 to the line, at which time if a coin has actually been deposited, the lamp 36 will be extinguished as in the normal operation previously described. If, however, the lamp 36 again flashes thus indicating either some fault in the coin box mechanism or circuit, or a deliberate intent on the part of the subscriber to defraud by not paying for the call, the operator may make a suitable record of the circumstances, operate the release key to stop the lamp from flashing and withdraw plugs 2 and 24, whereupon all relays will release and the circuits return to normal in readiness for another connection.

The operation of the invention will now be discussed for the aforementioned non-standard condition (b), under which condition ground is not removed by the application of coin collect current. The description before given for standard operation applies up to the point where relay 38 operates for the third time. As hereinbefore described relay 39 now operates to connect to the line for the second time, coin collect battery 33. Due to the non-removal of ground at station A by the first application of coin collect current relay 35 operates for the second time and when relay 49 operates on the third opening of the lower or pulsing contact of relay 38, a circuit is closed for operating relay 58, which may be traced from ground on the operated contacts of relay 35, through lower, outer operated contacts of relays 49 and 32 and winding of relay 58 to battery. Relay 58 in operating extends its operating ground through its inner contacts to the lower winding of relay 37, which also operates. Relay 37 in operating locks through its lower winding and upper contacts to ground on the break contacts of relay 55, transfers lamp 36 from the steady ground on conductor 41 to the interrupter ground of interrupter 56. Relay 58 also locks to ground through its inner and middle make contacts to ground on the back contact of relay 55, and also flashes lamp 57 with its outer make contacts from ground on interrupter 56. Relay 37 in operating also operates release relay 31 which disconnects coin battery 33 and, excepting relays 37 and 58, which are locked under control of relay 55, releases all coin control relays including relay 29, the release of which releases relay 31. The flashing of both lamps 36 and 57, is accordingly an indication that conductor 22 at station A is improperly grounded, fraudulently or otherwise. Under this condition, it is, of course, possible that the coin box mechanism did not function properly the first time and, if the instructions given the operator permit, she may make a second attempt to retire the lamp by again operating the collect key C after having

operated the release key 59 to stop the lamps from flashing. If the second operation of the key C results in lamps 36 and 57 again flashing, the operator may make a record of the circumstances for transmission to the trouble desk after which she will again operate the release key 59 and remove the plugs from jacks 3 and 25 thus permitting the circuit to restore to normal.

What is claimed is:

1. In a prepayment coin system for telephone exchanges in which the subscriber, when calling another line, is required to deposit a coin in a receiving means which thereupon functions to connect ground to the line and in which the deposited coin is disposed of by currents of a predetermined potential applied to the line at the central office and the ground is removed from the line upon disconnection of the disposal current therefrom, automatic means initiated at the central office for periodically transmitting impulses of said disposal current to the line, a signal lamp, and means adapted to automatically flash said lamp if the first impulse transmitted to the line does not encounter a ground condition thereon.

2. In a prepayment coin system for telephone exchanges in which the subscriber, when requesting connection with another line, is required to deposit a coin in a receiving means which thereupon functions to connect ground to the line and in which the deposited coin is disposed of by current of a predetermined potential applied to the line at the central office and the ground is removed from the line upon disconnection of the disposal current therefrom, automatic means initiated at the central office for periodically transmitting impulses of said disposal current to the line, a signal lamp, means to intermittently light said lamp at a predetermined rate and means to operate said intermittent means jointly responsive to the first and second current impulses encountering ground on the line.

3. In a prepayment coin system for telephone exchanges in which the subscriber, when calling another line, is required to deposit a coin in a receiving means which thereupon functions to connect ground to the line and in which the deposited coin is disposed of by current of a predetermined potential applied to the line at the central office and the ground is removed from the line upon disconnection of the disposal current therefrom, automatic means initiated at the central office for periodically transmitting impulses of said disposal current to the line, a signal lamp, means responsive to initiation of said automatic means to steadily light said lamp and other means adapted to automatically change said steadily lighted lamp to a flashing lamp either if no ground is encountered by the first impulse or if ground is encountered by both the first and second impulses.

4. In a prepayment coin system for telephone exchanges in which the subscriber, when calling another line, is required to deposit a coin in a receiving means which thereupon functions to connect ground to the line and in which the deposited coin is disposed of by current of a predetermined potential applied to the line at the central office and the ground is removed from the line upon disconnection of the disposal current therefrom, automatic means initiated at the central office for periodically transmitting impulses of said disposal current to the line, a signal lamp, means responsive to initiation of said automatic means for steadily lighting said

lamp, other means adapted to automatically flash said lamp either when the first applied current impulse does not encounter ground on the line or when both the first and second impulses encounter ground, a second lamp, and means to automatically flash said second lamp in unison with the first lamp only when the first and second impulses encounter ground.

5. In a prepayment coin system for telephone exchanges in which the subscriber when calling another line is required to deposit a coin in a receiving means which thereupon functions to connect ground to the line and in which the deposited coin is disposed of by current of a predetermined potential applied to the line at the central office and the ground is removed from the line upon disconnection of the disposal current therefrom, automatic means initiated at the central office for periodically transmitting impulses of said disposal current to the line, first and second signal lamps, means responsive to initiation of said automatic means to steadily light said first lamp, and other means responsive to absence of ground on the line when the first impulse is transmitted to flash said first lamp and to flash both the first and second lamps if the first and second impulses both encounter ground on the line.

6. In a prepayment coin system for telephone exchanges in which the subscriber is required to deposit a coin in a receiving means which thereupon functions to connect ground to the line and in which the deposited coin is disposed of by current of a predetermined potential applied to the line at the central office and the ground is removed from the line upon disconnection of the disposal current therefrom, automatic means initiated at the central office for periodically transmitting impulses of said disposal current to the line, a signal lamp, means responsive to initiation of said automatic means to steadily light said lamp, and other means adapted to change said steadily lighted lamp to a flashing lamp and to discontinue the transmission of said impulses if the first impulse transmitted to the line does not encounter a ground condition thereon.

7. In a prepayment coin system for telephone exchanges in which the subscriber is required to deposit a coin in a receiving means which thereupon functions to connect ground to the line and in which the deposited coin is disposed of by current of a predetermined potential applied to the line at the central office and the ground is removed from the line upon disconnection of the disposal current therefrom, automatic means initiated at the central office for periodically transmitting impulses of said disposal current to the line, a signal lamp, means responsive to initiation of said automatic means to steadily light said lamp, and other means adapted to change said steadily lighted lamp to a flashing lamp if the first impulse transmitted to the line does not encounter a ground condition thereon, to discontinue the transmission of said impulses and to cause said lamp to continue flashing after said impulses have been discontinued.

8. In a prepayment coin system for telephone exchanges in which the subscriber is required to deposit a coin in a receiving means which thereupon functions to connect ground to the line and in which the deposited coin is disposed of by current of a predetermined potential applied to the line at the central office and the ground is removed from the line upon disconnection of the disposal current therefrom, automatic means initiated at the central office for periodically

transmitting impulses of said disposal current to the line, a signal lamp, means responsive to initiation of said automatic means to steadily light said lamp, and other means adapted to change said steadily lighted lamp to a flashing lamp and to discontinue the transmission of said impulses if the first and second impulses transmitted to the line both encounter ground thereon.

9. In a prepayment coin system for telephone exchanges in which the subscriber is required to deposit a coin in a receiving means which thereupon functions to connect ground to the line, and in which the deposited coin is disposed of by current of a predetermined potential applied to the line at the central office and the ground is removed from the line upon disconnection of the disposal current therefrom, automatic means initiated at the central office for periodically transmitting impulses of said disposal current to the line, a signal lamp, and other means adapted to intermittently flash said lamp if the first and second impulses transmitted to the line both encounter ground thereon, said other means being also adapted to discontinue the transmission of said impulses and to cause said lamp to continue flashing after said impulses have been discontinued.

10. In a prepayment coin system for telephone exchanges in which the subscriber is required to deposit a coin in a receiving means which thereupon functions to connect ground to the line and in which the deposited coin is disposed of by current of a predetermined potential applied to the line at the central office and the ground is removed from the line upon disconnection of the disposal current therefrom, automatic means initiated at the central office for periodically transmitting impulses of said disposal current to the line, a signal lamp, means responsive to initiation of said automatic means to steadily light said lamp, and other means adapted to automatically change said steadily lighted lamp to a flashing lamp and to discontinue the transmission of said impulses either if no ground is encountered by the first impulse or if ground is encountered by both the first and second impulses.

11. In a prepayment coin system for telephone exchanges in which the subscriber is required to deposit a coin in a receiving means which thereupon functions to connect ground to the line and in which the deposited coin is disposed of by current of a predetermined potential applied to the line at the central office and the ground is removed from the line upon disconnection of the disposal current therefrom, automatic means initiated at the central office for periodically transmitting impulses of said disposal current to the line, a signal lamp, means responsive to initiation of said automatic means to steadily light said lamp, and other means adapted to automatically change said steadily lighted lamp to a flashing lamp either if no ground is encountered by the first impulse or if ground is encountered by both the first and second impulses, said other means being also adapted to discontinue the transmission of said impulses and to cause said lamp to continue flashing after said impulses have been discontinued.

12. In a prepayment coin system for telephone exchanges in which the subscriber is required to deposit a coin in a receiving means which thereupon functions to connect ground to the line and in which the deposited coin is disposed of by current of a predetermined potential applied to the line at the central office and the ground is removed from the line upon disconnection of the

disposal current therefrom, automatic means initiated at the central office for periodically transmitting impulses of said disposal current to the line, first and second signal lamps, means responsive to initiation of said automatic means to steadily light said pilot lamp and other means responsive to absence of ground on the line when the first impulse is transmitted to flash said first lamp, and to flash both the first and second lamps if the first and second impulses both encounter ground on the line, said other means being also adapted when operated to discontinue the transmission of said impulses.

13. In a prepayment coin system for telephone exchanges in which the subscriber, when requesting connection with another line, is required to deposit a coin in a receiving means which thereupon functions to connect ground to the line and in which the deposited coin is disposed of by current of a predetermined potential applied to the line at the central office under control of an operator and the ground is removed from the line upon disconnection of the disposal current therefrom, automatic means initiated by the operator for periodically transmitting impulses of said disposal current to the line, first and second signal lamps, means responsive to initiation of said automatic means to steadily light said first lamp and other means responsive to absence of ground on the line when the first impulse is transmitted to flash said first lamp, and to flash both the first and second lamps if the first and second impulses both encounter ground on the line, said other means being also adapted when operated to discontinue the transmission of said impulses and to cause said lamp or lamps to continue flashing under control of the operator after said impulses have been discontinued.

14. In a prepayment coin system for telephone exchanges in which grounding the line at a subscriber's station, by the deposit of a coin, is required to secure a connection with another line, and in which the coin is disposed of and the ground removed by current of a predetermined potential transmitted from the central office over the subscriber's line, the transmission of said disposal potential being initiated by means controlled at the central office, a talking key at the central office, and means controlled by an operator for testing said subscriber's line for ground, said last means being only effective when the talking key is operated and prior to initiation of said potential transmission.

15. In a prepayment coin system for telephone systems, a subscriber's station, a central office, a line connecting said station and the central office, a device at said station adapted to receive a coin and responsive thereto to connect ground to the associated line, a cord circuit at the central office adapted to be connected to said line, an operator's telephone adapted to be connected to the cord circuit, a source of audible frequency current, relay means adapted, when connected to ground, to connect said audible source to said operator's telephone, and operator controlled means effective, when the operator is connected to the cord, to connect the said relay means to a talking conductor thereof whereby if the cord circuit is connected to a grounded line said audible source will be connected to the telephone.

16. In a prepayment coin system for telephone systems, a calling subscriber's station, a central office, a line connecting said calling station and central office, a called line, a device at said call-

ing station adapted to receive and hold in suspense a coin and responsive thereto to connect ground to the line, a link circuit at the central office adapted to connect said calling line to the called line, means controlled at the central office for transmitting current of a predetermined potential over said cord circuit and calling line to dispose of said coin, and a guard lamp adapted to be lighted responsive to connection of said link circuit to said called line and extinguished responsive to operation of said disposal means.

17. In a prepayment coin system for telephone systems, a subscriber's station, a central office, a line connecting said station and said central office, a device at the station adapted to receive and hold in suspense a coin and responsive thereto to connect ground to the line, a common battery link circuit at the central office including a grounded source of direct current for supplying talking current, a grounded source of coin potential, means for initiating the connection of said coin potential source to the link to dispose of a coin held in suspense at the subscriber's station, a source of non-grounded direct current, and means responsive to the actuation of said initiating means to initially connect said non-grounded source to the link in parallel with said grounded source of talking current and thereafter to disconnect said grounded source of talking current from the link before said source of coin potential is connected to the line.

18. In a prepayment coin system, a coin box line, a common battery cord circuit adapted to be operatively connected thereto, a grounded source of direct current associated with said cord circuit for supplying talking energy thereto, a second grounded source of current, switching means for initiating the connection of said second source to the cord for effecting the disposal of a coin at a subscriber's station, a non-grounded source of direct current, and means responsive to actuation of said coin disposal switching means for substituting said ungrounded source of current for said first grounded source during the interval said second source of current is connected to the cord.

19. In a common battery link circuit arranged for prepayment coin service including a grounded source of direct current for talking purposes, a source of coin disposal current, switching means for initiating the connection of said coin disposal current to the link, a non-grounded source of direct current, and means responsive to operation of said switching means for substituting said non-grounded source for said grounded source before said disposal current is connected to the link.

20. In a common battery link circuit arranged for prepayment coin service, including a grounded source of direct current for supplying talking current thereto, a source of coin disposal current, switching means for initiating the connection of said coin disposal current to the link, a source of rectified direct current comprising a source of alternating current, a rectifier and filter, and means responsive to operation of said switching means for substituting said rectified source for said grounded source before and during connection of said disposal current to the link.

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